ised by immediacy. But this immediacy, if we have understood the author correctly, is always relative: the reasoning has been so swift that we have not noticed the stages. Intuition is simply a telescoping of that imaginative experimenting in which all reasoning consists. No one, we venture to suggest, would adopt such a view had he studied instinctive behaviour directly and in its general aspect without attempting to base theories of genesis on specially induced experiments, whether on the infusoria or on the higher vertebrates. The theory may not be wrong, but the method is suspect.

One of the most penetrating and instructive sections is the critical review of the forms of mathematical reasoning. Algebra stands at the top of the scale, logistic at the bottom. The former never parts company completely with the concrete as the latter does. Moreover, logistic stands condemned in our author's view for its utter inability to advance by reasoning to any new fact. Creative imagination is the driving force of reasoning, and this is not only absent from, but also definitely eschewed by, logistic.

Where Signor Rignano will seem to some to fail is in what he denies rather than in what he affirms. The concept when detached from the sensible imagination is for him purely verbal. A concept, self-contained and self-subsistent, a concrete universal, has no place in his theory of reasoning, and in itself is unintelligible. The polemic against metaphysics seems to us the weakest part of his book, and as it is quite unnecessary to his argument its introduction is to be regretted. The metaphysical inquirer is described as one who is determined at all costs to save values. He is moved by affective, and not by intellective, motives. The reply is simply that, as a matter of fact, it is notoriously untrue. The philosopher, as philosopher, is absolutely indifferent to values as values. What impels him to metaphysical inquiry is not desire, or emotion, or affective consideration of any kind; it is the pure need of intellectual satisfaction. Even the author protests that the most "positive" and least metaphysical of inquirers cannot be indifferent to values—why, then, is it presumed to vitiate the motive in one case and not in the other?

Regarded from the author's point of view, as it should be, the book is full of interest, clear and sustained in its argument, and maintained throughout at a high level. We hope there will be a good English translation, for it should prove an excellent text-book for advanced courses.

H. WILDON CARR.

## Text-books on Theoretical Chemistry.

(1) *Die chemische Literatur und die Organisation der Wissenschaft.* By W. Ostwald. (*Handbuch der allgemeinen Chemie.* Band 1.) Pp. iv+120. (Leipzig: Akademische Verlagsgesellschaft m.b.H.: Gustav Fock, 1919.)

(2) *The Foundations of Chemical Theory.* By Prof. R. M. Caven. Pp. viii+266. (London: Blackie and Son, Ltd., 1920.) 12*s*. 6*d*. net.

(3) *Inorganic Chemistry.* By E. I. Lewis. Third (revised and enlarged) edition. Pp. xv+443. (Cambridge: At the University Press, 1920.) 9*s*. net.

(1) PROF. OSTWALD'S book constitutes vol. i. of the "Handbuch der allgemeinen Chemie" which he is editing in conjunction with a number of eminent collaborators—Kuenen, Drucker, Marc, Bruni, Dutoit, Cohen, Halban, Bredig, and others—all recognised authorities on the several sections of physical chemistry to which they contribute. This introductory volume is, in effect, a long and discursive essay on the methods of propaganda of science and on the gradual development of the means of disseminating scientific truth. It traces the spread of scientific knowledge through the agency of societies, general and specialised, by means of discussion and publication, by scientific journals, and lastly by treatises, monographs, and text-books. It contains nothing but what is generally known to those familiar with the history of science, but the story is put together with considerable skill, and constitutes an eminently philosophical disquisition on an aspect of that history which has hitherto had few expositors.

Towards the conclusion of his essay Ostwald gives a free rein to his imagination in seeking to forecast the lines upon which the dissemination of scientific knowledge must proceed in the future. He is thus naturally led to what is an obsession with him—the possibility of the universal language—and we are treated to a short *excursus* on the relative merits and disadvantages of Volapük, Esperanto, and Ido. Recent events, for which Prof. Ostwald's own countrymen are wholly responsible, have absolutely shattered whatever hopes he may have entertained of the speedy realisation of his ideals. But, as he says in his preface: "Die Schrift wurde bereits 1914 fertiggestellt und gesetzt: die Ausgabe ist durch den Weltkrieg bisher verzögert worden." To allow the concluding paragraphs to remain unaltered when the work appeared in 1919 is characteristic of German mentality. It requires a very robust faith in the future to believe in their appositeness in present circumstances. We fear that the probability of the learned author being called upon again to preside over such a gathering in Paris as that which met there in 1907 to discuss the universal language is, to say the least, very remote. Nor have the prospects of German co-operation in the International Association of Chemical Societies, which Prof. Ostwald laboured to found when in Paris, and the Belgian manufacturer, Ernest Solvay, so generously endowed, been rendered any brighter by Prof. Ostwald's subsequent action in connection with the notorious *pronunciamiento* of German "intellectuals," directed against his quondam friends in France and England.

(2) Prof. Caven's book on "The Foundations of Chemical Theory" is an attempt to explain the fundamental conceptions which constitute the basis of the modern theory of chemistry. It is avowedly an introductory text-book, primarily intended for the young student with an elementary knowledge of the science; but it is also hoped that it may be within the compass of the general reader who, in the words of the preface, "wishes to know what modern chemistry really means." We fancy that the general reader who peruses the book will have a rude awakening in that respect. Recent occurrences have led him to believe that modern chemistry is mainly a matter of munitions—high explosives and poison-gases. He will find nothing relating to these subjects in the book, but he will be introduced to such eminently non-militant matters as the atomic and molecular theory, the periodic law, the doctrine of valency, reversible reactions, complex ions, and catalysis. The scope of the book is thus sufficiently indicated. In fourteen chapters distributed over 262 pages the author describes in simple and concise language the main principles and facts upon which theoretical chemistry rests.

The work is well written and forms interesting reading. The judgment of the author is, however, occasionally open to question. There are, for example, two opinions as to the expediency of the standard $O=16$ adopted, largely at the suggestion of the Germans, by the International Committee on Atomic Weights. At the recent conference in Rome it was proposed—and the proposition was favourably received—that the committee should revert to the old standard $H=1$. Prof. Caven expresses the hope that no such modification of the standard will be made. There is no question that any change will lead to confusion, but it is open to doubt whether the consequences will be so serious as Prof. Caven surmises. Even under a constant standard there have been numerous instances of changes in the value of an atomic weight, due, not to the variable standard, but to improvements in the methods of determining the constant. The atomic weight of chlorine, which the author adduces as an instance of confusion due to a changing standard, has been referred to a constant standard for many years past; but the value has suffered a progressive diminution owing to more rigorous experimental inquiries. The same is true of several of the fiduciary values employed in atomic-weight determinations. At the same time, there is much to be said for the retention of the present standard. It is remarkable how many of the atomic-weight values approximate to whole numbers, and are thereby more easily remembered and more convenient in use. The contention of Stas has lost much of its force, since the ratio of $H:O$ is now known to a very high degree of accuracy. The question is certain to be discussed by the reorganised committee in the near future, and it will largely turn on the relative merits of rationalism and expediency, for which the recent re-issue of Lord Morley's "Compromise" may well prepare the members.

For an elementary text-book the work may be said to cover its subject-matter adequately, and it is put together with a due sense of proportion. It is reasonably up-to-date, and, so far as we have been able to discover, it is free from errors. We would, however, point out that Hofmann's name in the table of contents is wrongly spelled, and the mistake is repeated on pp. 27 and 29.

The student who works through this book carefully and intelligently will acquire a considerable stock of chemical facts, and gain a sound knowledge of the generalisations to which they have led.

(3) Mr. Lewis's book on inorganic chemistry, originally published in 1907, is now in its third edition. It is designed for school teaching, and in the preface to the first edition, which is reprinted, the author describes his methods and the plan of his course of lessons. No attempt is made to cover the whole ground of inorganic chemistry; this is not called for where the main object is to teach principles and illustrate them by relevant facts. The plan of the work is original and has evidently been well thought out; for advice concerning it Mr. Lewis was indebted to many Cambridge friends, among them the late Mr. Humphry Jones and the late Mr. F. H. Neville. Mr. Lewis is, indeed, very faithful to his *alma mater,* and he loses no opportunity of acknowledging his gratitude to her and her sons. The lessons are accompanied by carefully chosen experiments, the apparatus for which is illustrated by figures in line drawing.

Each section is followed by "problems," some of which, it must be admitted, are absurdly "academic." Thus, to give the weight of a crucible as 26·59625 grams is what the Germans call "Decimalspielerei," and is apt to convey a perfectly illusory impression of the degree of accuracy attained in an ordinary weighing. The problems should be not so much arithmetical exercises as examples of the principles involved, and to this end it is unnecessary and unwise to inflict upon the student an unwieldy row of decimals which, especially in the hurry of written examinations, may land him into arithmetical blunders and so defeat what should be the real object of the examiner. It is also desirable that foreign proper names should be correctly spelled. The colleague of Dulong in the formulation of the law connecting atomic weight with specific heat is not usually styled Pettit (p. 141), nor, although there are variants in the name, is Ingen Houss (p. 183) commonly so written. Oxygen was discovered by Priestley on August 1, 1774, and not in 1775, as stated on p. 249 and elsewhere. As a matter of fact, Priestley had prepared it from nitre in 1771 without actually recognising it. Scheele, as is now known, was an independent discoverer, and had probably obtained the gas some time prior to 1774; but his first announcement of its existence was made in his treatise on Air and Fire, published in 1777.

Every conscientious teacher, properly equipped with knowledge and experience, and gifted with sympathy and enthusiasm, evolves his own methods of instruction sooner or later; but he can always learn from other teachers, even if at times it is only the negative gain of "how not to do it." From Mr. Lewis his gain will be positive. He will find his system rational and well-ordered, his methods of exposition clear and direct, and his experimental illustrations carefully chosen and strictly to the point.

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## A Jungle Book.

*The Diary of a Sportsman-Naturalist in India.* By E. P. Stebbing. Pp. xvi + 298. (London: John Lane; New York: John Lane Co., 1920.) 21*s.* net.

A GREAT part of Mr. Stebbing's book is devoted to the sport and natural history of the big-game jungles of India, and no reader will escape their fascination. They are so primitive, so wild, so full of the unexpected, so tragic in their hidden vestiges of remote civilisation, and withal so rich in possibilities of present-day pleasure—to the sportsman-naturalist especially.

> "The log fire burning and crackling merrily outside, the subdued buzz of talk from the servants' lines, the whinnying of the picketed ponies or the shrill voices of the syces raised in execration when a biting or kicking match commences, the dull rumbling of the elephants engaged on their fodder, resembling distant thunder; the great columns of trees forming a background to the camp, on to which the camp-fires cast fitful shadows, whilst overhead the picture is closed in by the blue-black vault picked out with innumerable jewels and spangled with diamond dust. How pleasant it all is. . . ."

Mr. Stebbing tells of his first bull bison (*Bos gaurus*), his first sambhar stag, his first tiger, his first leopard, his first bear, his first boar, not to speak of creatures like pangolins and porcupines which the naturalist enjoyed and the sportsman spared. It is a sanguinary book, but it is very well written, and the tale is adorned with vivid thumbnail sketches by the author and with excellent photographs by Mrs. Stebbing, Mrs. E. M. Sparkes, and Sir John Prescott Hewett.

Mr. Stebbing's general impressions of the jungle are very interesting. One is the warning which the jungle folk pass on when danger is approaching. "This warning, though intended for the friends of the utterer, is understood by the whole community, even though among themselves they may be respectively the oppressor and oppressed." From the moment the tiger or leopard is descried,

> "every animal in the jungle is put at once on its guard by the performance of the birds and monkeys. The deer know perfectly well what it portends, and remain on the alert till their enemy has left the neighbourhood. In fact, it is quite common for a tiger or leopard, once he has been discovered in a jungle, to be fairly mobbed out of it; for he knows that once all the jungle animals have been informed of his presence he has a poor chance of getting even a plump young doe to make his meal off."

Another impression is the great difficulty experienced in "picking up" the animals—from elephant to partridge—in their natural surroundings.

> "Even a large animal like the tiger can move along in his surroundings in an almost invisible manner. His outline becomes merged in the general colour of the grass or scrub jungle, but there is nothing definite to pick up, and when he is motionless he is almost invisible, if not quite, to the untrained eye. . . . It is usually the eyes of the animal which are first perceived if it is facing the observer. . . . Whilst, therefore, in a new environment and with an untrained eye, the newcomer finds some difficulty in picking out any of the animals in his neighbourhood from their surroundings, the reverse is the case with the jungle